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ABSTRACT

A research design is used to find out how effective a given piece of research has been. This short course in the fundamentals of research design is intended to bring together a few typical examples and a few generally accepted principles of research in a practical kit. After a brief introduction on how to progress from data that is uncountable to data that is countable, stress is placed on coming up with data that is accountable. Since analysis of research design must be done quickly and accurately, a shorthand notation is introduced that helps x-ray a wide variety of designs through common terminology. Whenever a piece of research has been analyzed in this framework, it is possible to distinguish valid design from invalid design. The second section of the document provides self-study material that can be used for independent study. This will give a brief introduction to the fundamentals of research design. (RC)

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TITLE

FUNDAMENTALS OF RESEARCH DESIGN

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This publication provides a brief introduction to RESEARCH DESIGN.

After a brief introduction on how to progress from data that is UNCOUNTABLE to data that is COUNTABLE, stress is placed on coming up with data that is ACCOUNTABLE.

Since analysis of a research design must be done quickly and accurately, a shorthand notation is introduced that helps x-ray a wide variety of designs through such common terminology as

C - Control group
X - Experiemtal group
O - Observations or measurements
R - Randomization

Whenever a piece of research has been analyzed in this framework, it is possible to distinguish valid design from invalid design.

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FUNDAMENTALS OF RESEARCH DESIGN

A research design is used to find out how effective a given piece of research has been. This short course in the fundamentals of research design is intended to give a few typical examples together with a few generally accepted principles of research.

Putting these two elements together into a practical kit is the objective of this document.

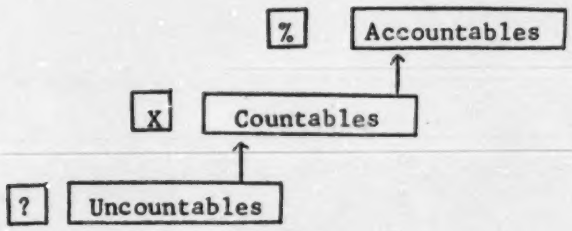
Even the most vague project, objectives can eventually be reduced to GO FORTH AND DO GOOD! In other words, the originators of the project or proposal are certainly motivated by good intentions.

On the other hand, the necessity to set up a research and evaluation design requires the researchers and evaluators to come up with:

1. Countables,
2. Quality measures, and
3. Observable student benefits that document a measurable impact.

PROGRESS TO THE TOP

The following chart shows the progress made from UNCOUNTABLES to COUNTABLES to ACCOUNTABLES. The symbolic progress from "?" to "x" to "%" is summarized on the same chart.



An example of an UNCOUNTABLE mandate is the general charge, "Go forth and do good!"

An example of a COUNTABLE mandate is the charge, "Do good to at least 25 people."

An example of an ACCOUNTABLE mandate is the charge, "Do more good this year to more people than was done last year."

Obviously, none of the above three examples is proposed as a perfectly formulated objective. However, each of the three example objectives is proposed as being much more countable and accountable than the vague uncountable mandate.

PRACTICAL EXAMPLE

As part of an evaluation exercise, teachers were told to come up with both SELECTION OBJECTIVES and DISSEMINATION OBJECTIVES.

The selection objectives were to spell out the basis upon which audio-visual materials will be selected by specific subject matter teachers.

The dissemination objectives are intended to spell out the basis upon which materials will be evaluated for effectiveness in terms of impact upon individual learners.

The selection objectives are more complicated than would appear at first sight. For example, selecting films for a large number of different teachers in the same occupational area means trying to satisfy a large group of people, each with different interests and criteria.

There are other difficulties. A film that may not be appreciated by a specific evaluator might very well by exactly what a specific teacher is looking for to use with a specific group.

Even if the evaluators are perfect from a professional judgment point of view, few educators want to be told exactly what to do by an outside agency.

After discussion of the above ideas, a list of selection objectives and a list of dissemination objectives were developed. The selection objectives are reprinted on page 4 . The dissemination objectives are reprinted on page 5.

Pages 7-16 provide self-study material that can be used for independent study.

These pages will give a brief introduction to the fundamentals of research design.

SELECTION OBJECTIVES

AREA OF CONCERN	TYPICAL OBJECTIVE	SAMPLE COUNTABLE
COMMONALITY OF AREAS	Videotapes can be used in at least 8 out of 10 participating BOCES	For each film, count the number of BOCES that use the videotape.
COST EFFECTIVENESS	16 mm film selected is available for duplicating on videotape within available funds	Count the number of films available for duplicating within existing funds. Count the number of films desired but not duplicated because of excess cost.
TEACHER INVOLVEMENT	At least 3 teachers from at least 3 different BOCES favorably review each film to be videotaped.	Average out group rating from the teacher rating form for each film to determine priority ranking for each film.
OCCUPATIONAL RELEVANCY	At least 1 craft advisory group will approve occupational relevancy of films approved by teachers.	Every film approved by teachers will be subjected to approval by a craft advisory group using the same rating form used by teachers.

DISSEMINATION EVALUATION

AREA OF CONCERN	Typical Objective	SAMPLE COUNTABLE
AVAILABILITY	Each videotape will be made available to every participating instructor	Count the number of films made available on videotape. Count the number of teachers who have received the catalog of available videotapes.
UTILIZATION	Available videotapes will be utilized in the field.	Count the number of showings for each videotape. Count the number of students viewing each videotape. Add up totals for : SHOWINGS and STUDENTS.
TEACHER NEEDS	Expressed teacher needs will be satisfactorily met.	Count teacher responses to the following questions : Value of film to you? Overall rating of videotape? Would you use this videotape again? Did this videotape meet learners' needs?
LEARNER NEEDS	Expressed learner needs will be satisfactorily met.	Count teacher responses to the following questions : Number of students at original showing? at absentee showings? at relearning showings?

DISSEMINATION OBJECTIVES — Cont.

MAINTENANCE SURVEY	Adequate logistical support should be provided.	Count number of times usage was delayed, canceled, or impeded by technical breakdowns. Add up total dollar amount spent on repairs. Add up total number of hours consumed by staff on repairs.
WORK ORIENTED ACTIVITIES	Materials videotaped are fundamental to work-oriented activities.	Count number of videotape documentation pages that specify which of the following work-oriented activities are covered by the videotape : KO (KNOWLEDGE OBJECTIVES): acquire occupational content PO (PERFORMANCE OBJECTIVES learn a work skill AO (ATTITUDE OBJECTIVES): acquire positive job attitudes
EVALUATION BY OBJECTIVES	Learner success should be documented by hard data.	Count number of tests or evaluation instruments developed to measure learner success by hard data. Subdivide above count into number of items measuring KO, PO, or AO as defined above.
TEACHER PREVIEW	Each teacher should be able to preview each film before utilization to determine whether the film can do the job envisioned by the teacher.	For each teacher, a count will be kept of : FILMS USED and FILMS PREVIEWED

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PRETEST ON
EVALUATION DESIGNS

DIRECTIONS: Circle the answers selected on the ANSWER SHEET provided.

The following multiple choice question may have more than one required correct answer.

Compare the answers selected with the ANNOTATED SUGGESTED ANSWER KEY.

1. To develop an EVALUATION DESIGN is operationally to:

   A. Formulate statistical hypotheses which are testable formulations of research hypotheses.

   B. State decision rules to be followed during testing of hypotheses.

   C. Collect data according to a prespecified plan.

   D. Analyze data according to the same prespecified plan.

   E. Make decisions based upon inductive inferences concerning the probable truth or falsity of the research hypotheses.

   F. All of the above.

TRUE FALSE 2. The adequacy of an evaluation design depends upon the thoroughness with which the design handles the different threats to validity.

TRUE FALSE 3. It is usual in an experimental design to employ symbols as a type of shorthand for clarity of purpose and clarity of structure.

TRUE FALSE 4. In this designed shorthand, X is used to designate the presence of an experimental treatment.

TRUE FALSE 5. C is used to designate a control condition wherein the control is the absence of the experimental treatment.

TRUE FALSE 6. O is used to designate an observation or measurement.

TRUE FALSE 7. R indicates that factors, such as selection, have been controlled by using randomization.

TRUE FALSE 8. In this shorthand notation, a one-shot case study is summarized as X O which means that some treatment X has been tried on a single group and that an observation has been made of that group after the treatment.

TRUE FALSE 9. In the one-group pretest-posttest format, O X O means that a pretest observation was followed by an experimental treatment which was then followed by a posttest observation.

TRUE FALSE 10. In intact-group comparisons, the formulation X O vs. C O means that one group received the experimental treatment, that another group did not receive the experimental treatment, and that both groups were observed.

TRUE FALSE 11. Format 1 (X O), format 2 (O X O), and format 3 (X O vs. C O) are all subject to various validity threats because of inadequate evaluation design.

12. The valid evaluation designs among the following include:

A. (X O)
B. (O X O)
C. (X O vs. C O)
D. (R X O vs. R C O)
E. (R O X O vs. R O C O)

13. The shorthand coding for posttest-only control group design is:

A. (X O)
B. (O X O)
C. (X O vs. C O)
D. (R X O vs. R C O)
E. (R O X O vs. R O C O)

14. The shorthand notation for pretest-posttest conrol group design is:

A. (X O)
B. (O X O)
C. (X O vs. R O)
D. (R X O vs. R C O)
E. (R O X O vs R O C O)

ANSWER SHEET

1. A B C D E F

2. TRUE FALSE

3. TRUE FALSE

4. TRUE FALSE

5. TRUE FALSE

6. TRUE FALSE

7. TRUE FALSE

8. TRUE FALSE

9. TRUE FALSE

10. TRUE FALSE

11. TRUE FALSE

12. A B C D E

13. A B C D E

14. A B C D E

ANNOTATED SUGGESTED ANSWER KEY

1. F
2. True
3. True
4. True _____X
5. True _____C
6. True _____O
7. True _____R
8. True _____X O
9. True _____O X O
10. True _____X O vs. C O
11. True _____inadequate design
12. D, E
13. D
14. E

POSTTEST FOR
EVALUATION DESIGNS

DIRECTIONS: Circle the answers selected on the ANSWER SHEET provided.

Compare the answers selected with the ANNOTATED SUGGESTED ANSWER KEY.

TRUE FALSE 1. A hypothesis is a tentative explanation.

TRUE FALSE 2. A hypothesis is tested by documenting empirical consequences.

TRUE FALSE 3. It can be safely asserted that a decision is only as good as the information or evidence upon which it is based.

TRUE FALSE 4. Decision rules developed after the empirical data is collected are subject to suspicions of experimental bias.

TRUE FALSE 5. Data collected according to a haphazzard plan is subject to suspicions of manipulation.

TRUE FALSE 6. Statistical research often attains probable truth as opposed to absolute truth.

TRUE FALSE 7. Researchers can work with probability as long as the researchers remain aware of the margin of error in even the most carefully documented experiment.

TRUE FALSE 8. The shorthand abbreviations used in questions 12 to 14 on the PRETEST resemble normal everyday speech.

TRUE FALSE 9. In the Alvir evaluation design shorthand, RANDOM replaces R to designate the fact that the groups selected have been controlled by using random selection.

TRUE FALSE 10. Similarily, PRE is used to stand for pretest and replaces O to designate an observation or measurement made before introduction of either the experimental or control variable.

TRUE FALSE 11. X remains unchanged and is used to designate the presence of an experimental treatment or of an experimental variable.

TRUE FALSE 12. C is unchanged and is used to designate a control condition wherein the control is the absence of the experimental treatment or of the experimental variable.

TRUE FALSE 13. POST is used to abbreviate posttest and replaces O to designate an observation or measurement made after the experimental treatment or after the control condition.

TRUE FALSE 14. In this new Alvir shorthand for experimental design, the faulty design of (X O) is replaced by X-POST.

TRUE FALSE 15. Any research that can be summarized by the design of X-POST is no longer faulty research.

TRUE FALSE 16. The faulty research design of (O X O) is replaced by the notation of PRE-X-POST.

TRUE FALSE 17. Research designed in the format of PRE-X-POST is faulty because there is no control group indicated.

TRUE FALSE 18. The faulty research design of (X O vs. C O) is summarized in the shorthand notation of X-POST vs. C-POST.

TRUE FALSE 19. The research design of X-POST vs. C-POST is correct because adequate provision has been given to random selection both of the control group and of the experimental group.

TRUE FALSE 20. The valid research design of (R X O vs. R C O) can be summarized in the Alvir notation by RANDOM-X-POST vs. RANDOM-C-POST.

TRUE FALSE 21. The valid evaluation design of RANDOM-X-POST vs. RANDOM-C-POST is less subject to sampling bias because the groups under experimental study and under experimental control have been selected at random.

TRUE FALSE 22. The valid evaluation design of (R O X O vs. R O C O) is replaced by the Alvir shorthand notation of RANDOM-PRE-X-POST vs. RANDOM-PRE-C-POST.

TRUE FALSE 23. The evaluation design of RANDOM-PRE-X-POST vs. RANDOM-PRE-C-POST is dangerous for a beginner to utilize because there is no evaluation design provision to make sure that the randomly selected experimental group and randomly selected control group are basically equivalent as measured by a pretest.

TRUE FALSE 24. A pretest of group equivalence can only be as valid as the relationship of the pretest items to the hypothesis under investigation.

TRUE FALSE 25. An experimental design for a pretest which claims the experimental group and the control are equivalent because of identical weight and identical age would not be appropriate for hypothesis testing that refers to characteristics or parameters not connected to body bulk or to learner age.

ANSWER SHEET

1. TRUE FALSE
2. TRUE FALSE
3. TRUE FALSE
4. TRUE FALSE
5. TRUE FALSE
6. TRUE FALSE
7. TRUE FALSE
8. TRUE FALSE
9. TRUE FALSE
10. TRUE FALSE
11. TRUE FALSE
12. TRUE FALSE
13. TRUE FALSE
14. TRUE FALSE
15. TRUE FALSE
16. TRUE FALSE
17. TRUE FALSE
18. TRUE FALSE
19. TRUE FALSE
20. TRUE FALSE
21. TRUE FALSE
22. TRUE FALSE
23. TRUE FALSE
24. TRUE FALSE
25. TRUE FALSE

ANNOTATED SUGGESTED
ANSWER KEY

ANSWER	ANNOTATION
1. True	hypothesis
2. True	empirical consequences
3. True	decision power
4. True	decision rules
5. True	prespecified plan
6. True	probability
7. True	margin of error
8. False	abbreviations
9. True	RANDOM
10. True	PRE
11. True	X
12. True	C
13. True	POST
14. True	X-POST (faulty)
15. False	FAULTY
16. True	PRE-X-POST
17. True	NO CONTROL
18. True	X-POST vs. C-POST
19. False	NO RANDOMIZATION
20. True	RANDOM-X-POST vs. RANDOM-C-POST
21. True	RANDOMIZATION
22. True	RANDOM-PRE-X-POST vs. RANDOM-PRE-C-POST
23. False	PRETEST EQUIVALENCE
24. True	HYPOTHESIS CORRELATION
25. True	RELEVANT PRETEST